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MIROSTENELLA ARTICULATA, A REMARKABLE NEW GENUS AND SPECIES OF PRIMNOID OCTOCORAL (GORGONACEA) WITH UNCALCIFIED AXIAL NODES

Frederick M. Bayer

Abstract.—A new genus and species are established for a primnoid octocoral having flexible organic nodes at the bifurcations of the heavily calcified axis. Its significance in the relationship of the Primnoidae to the Isididae is discussed and the need for further study is stressed.

Kükenthal (1915:144) considered the Primnoidae to be the most thoroughly investigated family of the order Gorgonacea thanks to the work of Studer (1878), Studer & Wright (1887), and Versluys (1906). After repeating that statement in his account of the gorgonians of the Valdivia Expedition, he presented a new treatment of the family based on 138 species distributed among 12 genera (Kükenthal 1919:311). Since that time, several new species have been described, and four new genera have been established, five elevated from subgeneric to generic rank, and one revalidated from synonymy.

Molander (1929) created a new subfamily Lycurinae for his *Lycurus antarcticus,* which Carlgren (1943) later reassigned to the genus *Ainigmaptilon* Dean, simultaneously renaming the subfamily Ainigmaptiloninae and elevating it to full family rank. Subsequently this family has been submerged within the Primnoidae (Bayer 1981:946).

Based upon such thorough investigation and comprehensive material, the diagnosis of the family Primnoidae as set forth by Kükenthal (1919:309; 1924:252) has subsequently undergone no substantial modification. Although the specifications regarding the development of the distalmost polyp sclerites as opercular scales do not fit some species precisely, the significant array of characters shared by all members of the Primnoidae has remained unchanged until now.

At station 1536 off South Georgia, USNS *Eltanin* obtained one of the richest hauls of gorgonian corals taken during the U.S. Antarctic Research Program. The gorgonian community at that locality was dominated by primnoids, among which were collected several specimens of a gorgonian of predominantly primnoid appearance but having a calcified axis with organic nodes suggestive of the Isididae. This species, not referable to any genus and species heretofore known, contradicts one of the basic diagnostic characters of the Primnoidae and raises some fundamental questions about the relationships of the families of holaxonian gorgonians having heavily calcified axes without a cross-chambered hollow core.

In his paper on the classification and phylogeny of the Primnoidae, Kükenthal (1915: 154) remarked that we know next to nothing about the relationships of the primnoids to the other families of Gorgonacea. This equivocal new species will necessitate a review of the gorgonian families and their relationships as well as a redefinition of the family Primnoidae.

Mirostenella, new genus

Diagnosis.—Dichotomously branched primnoid with polyps arranged in pairs or whorls of 3–4, with 8 complete rows of body

scales, opercular aligned with marginals. Calcified axis interrupted by organic nodes at points of bifurcation.

Type species.—*Mirostenella articulata,* new species, here designated.

Etymology.—Latin *mirus,* extraordinary, wonderful, from *miror,* to be astonished at + *Stenella,* name applied to a genus of primnoid gorgonians by J. E. Gray; in allusion to the similar arrangement of the polyps.

Mirostenella articulata, new species
Figs. 1–3

Material.—Off South Georgia: 54°29′S, 39°22′W to 54°31′S, 39°19′W, 659–686 m. *Eltanin* cruise 22, sta 1536, 8 Feb 1966. Holotype, USNM 79959; paratypes, USNM 79960; BM(NH) 1987.9.17.1; SMF 5687.

Diagnosis.—Dichotomously branched primnoid with calcified axis interrupted by organic nodes at points of bifurcation. Polyps in pairs or whorls of 3–4; marginal scales with smooth apical thorn or spine, longitudinally aligned with opercular scales.

Description.—Colonies (Fig. 1a–c) reach a height of about 8 cm and a width of about 10 cm, dichotomously branched mostly in one plane but with occasional strays out of the principal plane, attached by a small discoidal holdfast. As in other dichotomous primnoids examined, the bifurcations are not true dichotomies as in *Chelidonisis* and *Melithaea* because they originate as lateral branchlets from the primary axis of terminal twigs. The axis between bifurcations is of typical primnoid aspect, opaque straw yellow with metallic iridescence, and marked by conspicous longitudinal ridges and grooves; oval depressions, shallower than in most isidids but similar to those of other primnoids, mark the locations of desmocytes in the axis epithelium. At the points of bifurcation the axial material is translucent dark brown, smooth but without iridescence, forming flexible organic nodes between the rigid, heavily mineralized internodes. Sharp reduction of calcium at the nodes was verified by energy-dispersive X-ray analysis. The nodes are not so abruptly delimited from the internodes as in the Isididae; strands of pale calcified material extend from the internodes into the darker, translucent nodal substance. The bifurcations enclose angles of roughly 45°, often a little more or less; the internodes, including the basal one, range between 4 mm and 15 mm in length, and the unbranched terminal twigs may be as long as 3.5 cm, but most are shorter. The trunk of the largest colony is slightly over 1 mm in diameter including the coenenchyme; thereafter the internodes diminish in diameter distad, tapering to 0.04 mm (without coenenchyme) at the apex.

The polyps (Fig. 2) are arranged in widely spaced pairs or whorls of 3 or 4, of which 3 or 4 occur in 1 cm of branch length. The polyps are directed slightly upward, either straight or with a weak upward curvature, about 2 mm tall and 0.6 mm in diameter proximally, widening to 0.8–0.9 mm distally.

The sclerites of the polyps are thin scales of the usual primnoid type, nearly smooth on the outer surface but covered with small, complicated tubercles on the inner, with radial orientation of the component microcrystals resulting in a cruciform extinction pattern when viewed under crossed Nicols. Those of the distalmost circle (Fig. 3a) are 8 narrowly triangular sclerites about 0.4–0.5 mm tall, without a prominent keel on the inner surface of the apex. They close over the withdrawn tentacles and oral region as a low, conical operculum. The 8 marginal scales (Fig. 3b) surrounding the operculum are ellipsoidal, mostly 0.4–0.5 × 0.22–0.3 mm, their upper edge prolonged into a smooth, narrow spine 0.075–0.3 mm long; they are incapable of folding inward, hence are not a "circumoperculum" in the sense of Kükenthal (1919:329), but together they surround the operculum like a spiny diadem. The body sclerites (Fig. 3c) are thin, oval, squarish, or elongate scales about 0.3–0.35 mm in greatest dimension, placed in 8 longitudinal rows that may be somewhat disrupted by breakage; they diminish to

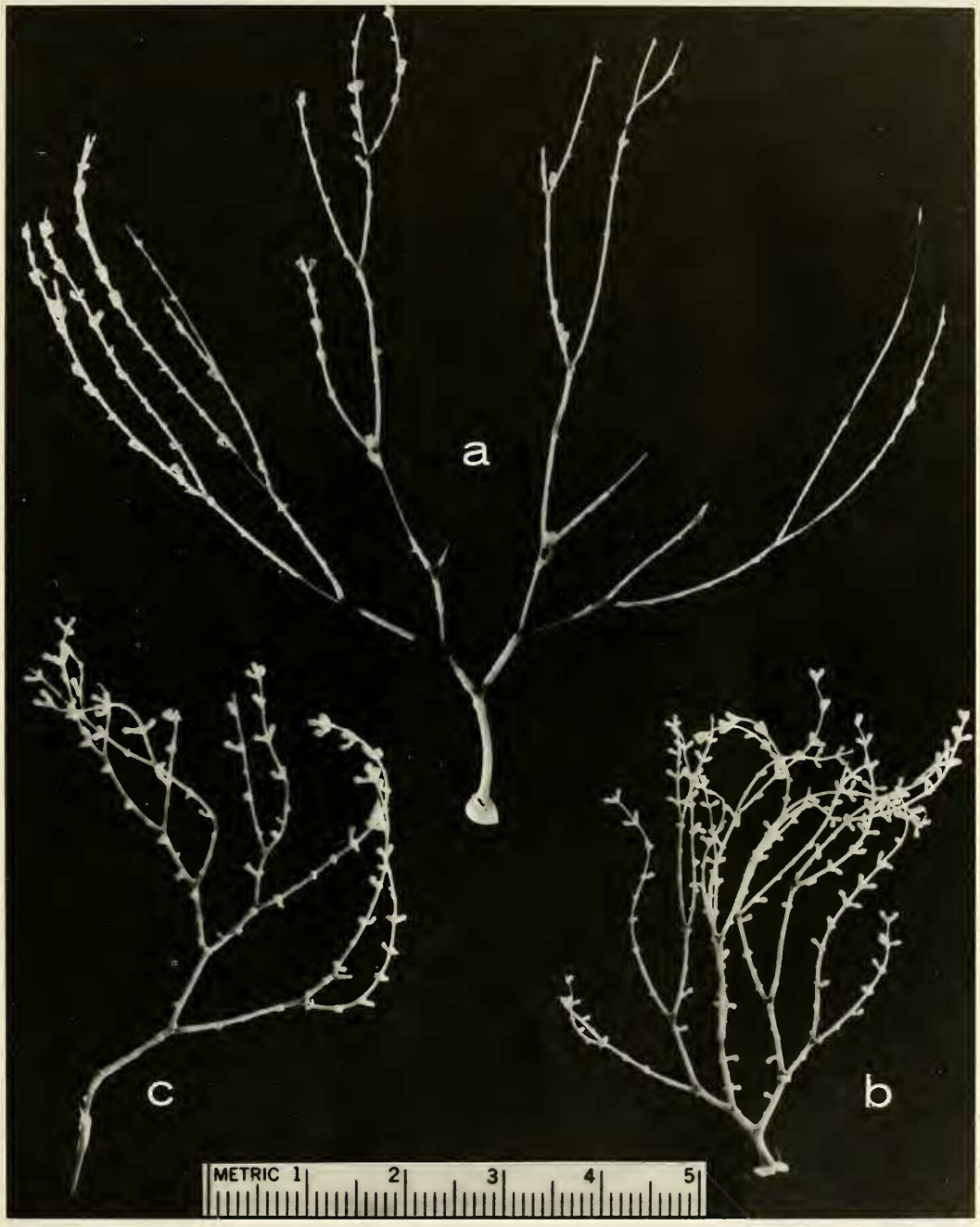

Fig. 1. *Mirostenella articulata*: a, c, Paratypes, USNM 79960; b, Holotype, UNSM 79959.

about 0.1 mm in diameter toward the base of the polyps, where they are discoidal in outline (Fig. 3d) and irregular in arrangement. The sclerites of the coenenchyme (Fig. 3e) are thick platelets up to 0.4 mm in length, of very irregular outline and covered with conspicuous bluntly conical projections.

Comparisons.—No primnoid so far de-

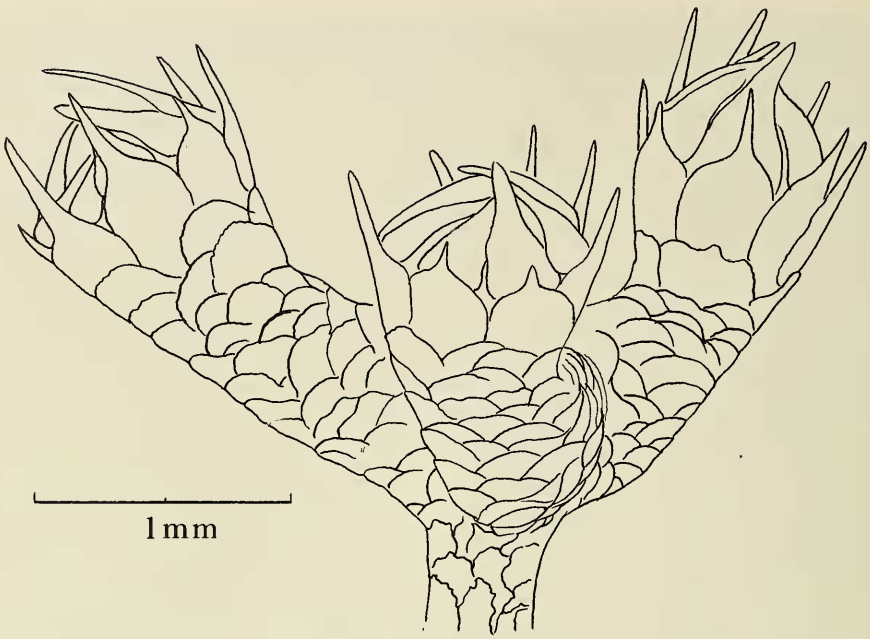

Fig. 2. *Mirostenella articulata*: Terminal whorl of three polyps.

scribed has organic nodes at the points of ramification of the calcified axis. The arrangement in pairs or whorls of the almost vertically placed polyps most closely resembles the condition in *Candidella, Parastenella,* and *Pterostenella,* but in the first of those there are only four marginal scales, in the second six, and in the last eight which alternate with the opercular scales, not in line with them as in the present case. In shape the polyps most closely resemble those of a few species of *Plumarella,* but in that genus the polyps are always isolated, never in whorls, and moderately to strongly recurved toward the axis.

Taxonomic implications.—The unequivocal presence of axial articulation in a primnoid species blurs the distinction of the family Primnoidae from the Isididae at the practical level. Before the significance of this axial feature can be evaluated, closer investigation of the structure in *Mirostenella articulata* is essential for comparison with isidid axial structure. Preliminary examination of the axis shows that it is formed on an organic matrix with a mineralized core, increasing in diameter proximad by the addition of concentric layers of mineralized tissue, presumably secreted by an axis epithelium as in other gorgonians. At the points of bifurcation, the layers of secondary thickening around the core fail to mineralize, resulting in purely organic nodes. This condition is certainly analogous with that of the isidid axis, and may well be homologous.

Kükenthal (1915:124; 1919:634, 712) considered the family Isididae to be polyphyletic, with the articulated axis arising independently four different times. He derived the subfamily Mopseinae from the primnoid stem partly on the basis of the similarity of the undulated concentric lamellae of the axis (Kükenthal 1919:712) and the scale-like form of the sclerites (Kükenthal 1919:637) to those of primnoids; the Isidinae from the Plexauridae; the Ceratoisidinae from the Gorgonellidae [=Ellisellidae]; and the Muricellisidinae from the Muriceidae [=Paramuriceidae].

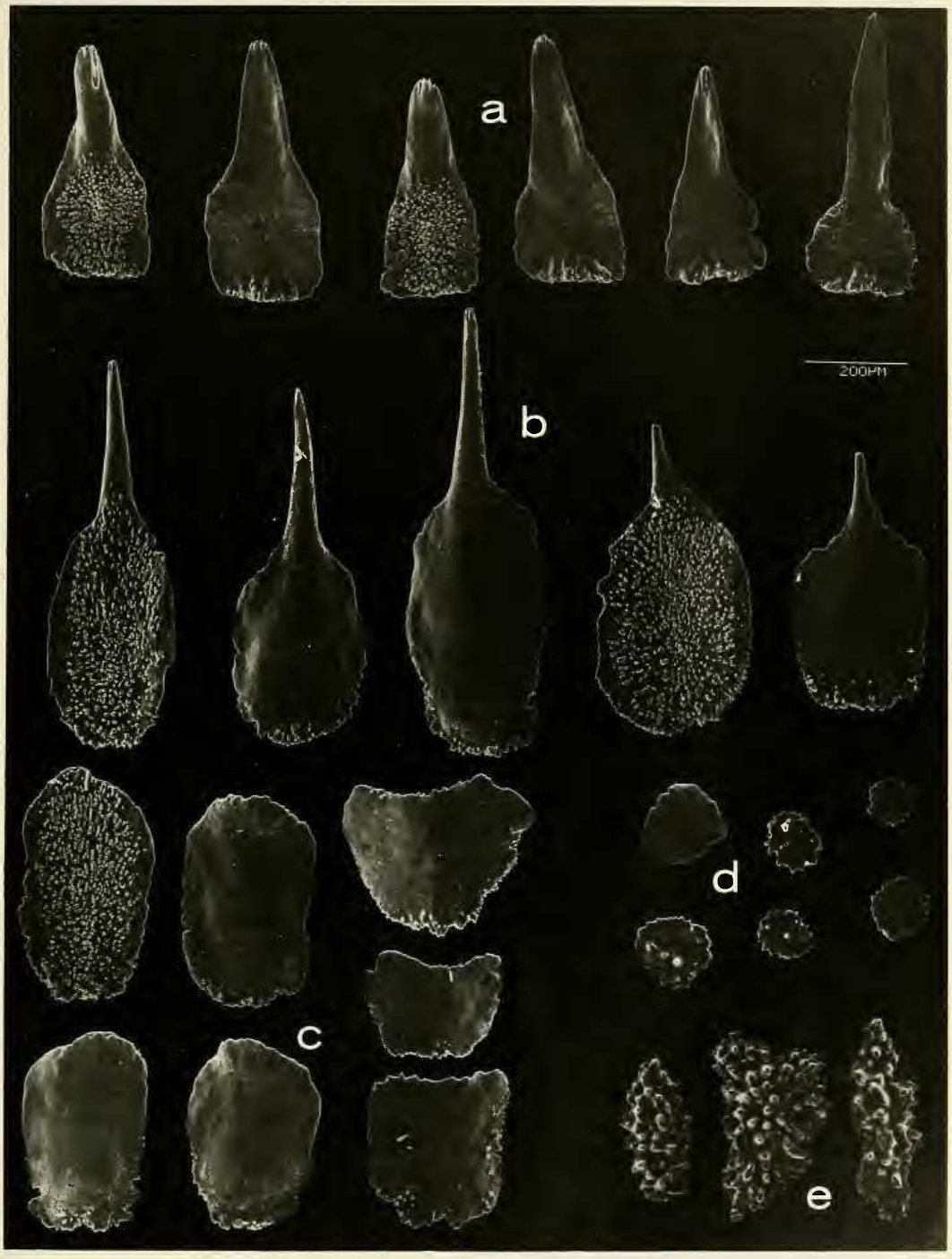

Fig. 3. *Mirostenella articulata,* sclerites: a, Operculars; b, Marginals; c, Of polyp body; d, From base of polyp; e, Of coenenchyme.

Now the discovery of an otherwise "typical" primnoid having a clear manifestation of axial articulation lends weight to a relationship of the isidids to the primnoids, but the other similarities may not be as significant as Kükenthal thought. The scales of Mopseinae such as *Primnoisis* are structurally more similar to those of chrysogorgiids than to those of primnoids, as the component microcrystals are oriented longitudinally rather than radially and thus do not yield a cruciform extinction pattern under crossed Nicols. Moreover, the undulate concentric lamellae of gorgonian axes are a reflection of the longitudinal grooving of the axial surface marking the course of coenenchymal stem canals, as is the case also in the Isidinae (e.g., *Isis hippuris*; Simpson, 1906:430). Both primnoids and isidids vary in this respect, and its phylogenetic significance would appear negligible.

At the present time it is premature to speculate upon the position of *Mirostenella articulata* relative to other primnoids, and its significance in the relationships of the gorgonacean families with calcified axes. The species is here placed on record to call attention to the complexities of phylogenetic speculation in the absence of a useful fossil record, and to stimulate further interest in the taxonomic and phylogenetic problems of the Octocorallia.

Abbreviations.—BM(NH) = British Museum (Natural History), London; SMF = Natur-Museum Senckenberg, Frankfurt; USNM = National Museum of Natural History (Department of Invertebrate Zoology), Smithsonian Institution, Washington, D.C.

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Department of Invertebrate Zoology, NHB-163, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.